7-8-2016

Optimizing Greenhouse Rice Production: What Is the Best Pot Size?

Robert Eddy
Purdue University, robeddy@purdue.edu

Kevin Acosta
Purdue University

Yisi Liu
Purdue University

Michael Russell
Purdue University

Purdue Methods: Optimizing Greenhouse Rice Production

What is the best pot size?

Short answer: 6-inch “standard round” pots, 15 cm-diameter x 14-cm tall. One plant per pot.

Since examining smaller pots in formal studies described below, we have increased the pot size for greenhouse rice production to 6-inch diameter pots. Coupled with deeper sub-irrigation trays, these larger pots made the crop system more robust by being able to withstand failures in the irrigation equipment. They also were more stable from tipping over. Finally, assuming the researcher used one plant per pot, the planting density was reduced, allowing more light penetration into the crop and facilitating pest control.

Pots larger than 15-cm diameter can be used for research, with multiple plants in the same pot. This would typically provide even more time before water stress during an irrigation failure and also make drip irrigation for each pot more suitable. Having drip emitters on the soil surface of each pot would most likely reduce the fertilizer accumulation prevalent in sub-irrigation systems. It should be noted that some of the researchers at our facility grow as many as three plants per 15-cm pot, though the panicle count is reduced due to light competition.

For those researchers interested in the use of smaller pots due to limited growing area, or the need to study very large numbers of plants, below we have provided results from our studies examining pots of smaller diameters. The studies were done using a different root media and a shallower sub-irrigation tray than we are currently recommending:

Under the conditions of these studies, 9-cm (4-inch) diameter square pots resulted in the greatest seed yield and panicle number as compared to 7-cm (3-inch) and 12.5-cm (5-inch) diameter pots.

Throughout the experiment, the 12.5-cm (5-inch) seemed sub-optimal. This seems counter-intuitive, as the larger pots provide more soil volume. Our best explanation is that the 4-inch pots coupled with the 3-cm deep sub-irrigation trays had a more ideal balance of air and water in the root environment due to the pot height, volume and shape. In other words, if the sub-irrigation trays that we used had been either deeper or shallower, another pot size may have proven most optimum. So it is important to remember that the components of a plant growth system are not

independent of each other.

The 7-cm pots (3-inch) square pots yielded seed despite a very small soil volume. We believe this bears closer examination by research institutions involved in growing large numbers of plants, either for breeding or high-throughput screening. Grown in less-dense conditions than were provided in this study, this pot size may prove beneficial. The challenge would be careful monitoring of irrigation to avoid water stress.

Figure 1. Rice grown in 6-inch pot under a fast production schedule, in full flower at 10 weeks from emergence. There are two pots, nested, with cheesecloth between them to prevent leakage of the root media through the drainage holes.

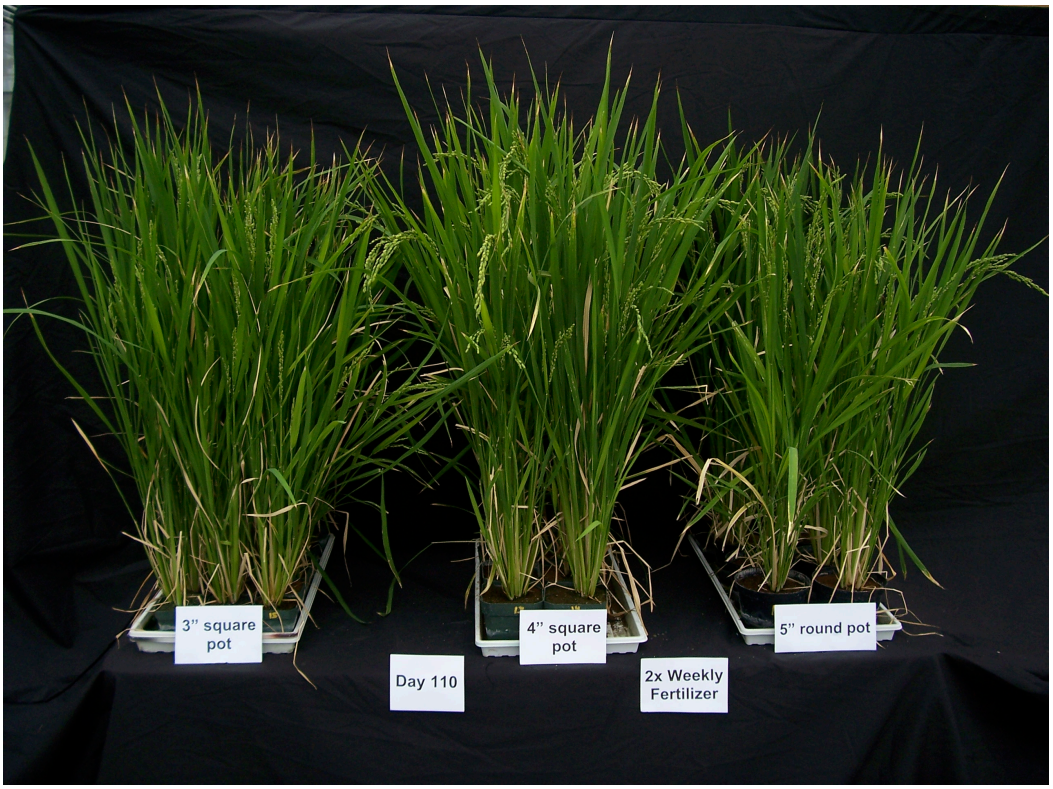

Figure 2. Rice growing in three pot sizes, from left: 7-cm, 9-cm and 12.5-cm diameter, respectively, at Day 110.

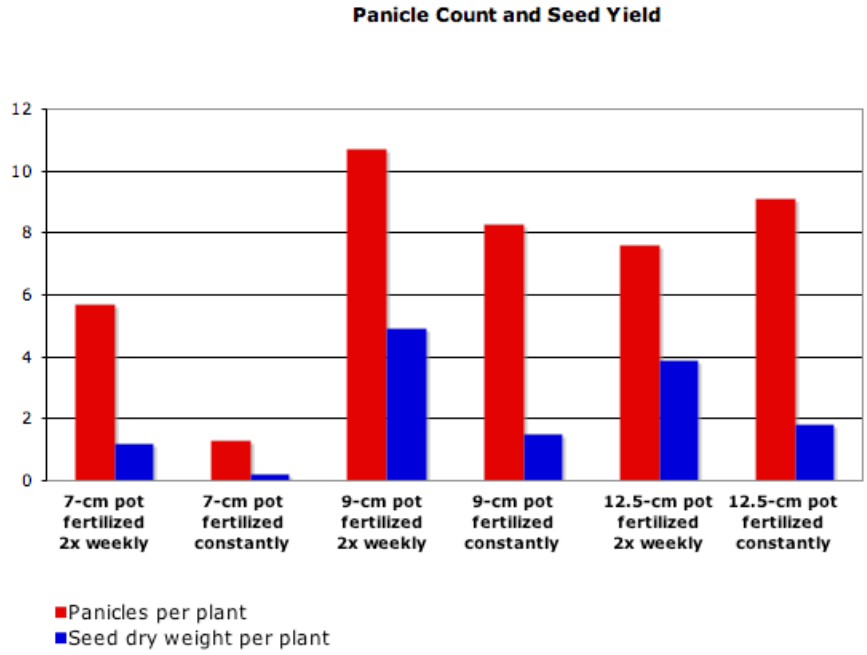

Figure 3. Rice plant panicle count and seed yield in three differing pot sizes and under two fertilization schedules.

Figure 4. Close up of rice plant grown in 7-cm pot.